AI Chatbots, it's Feasibility and Reliability in Modern World

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Abstract - *An AI chatbot is an artificially designed automatic response and dialog system. It can communicate with another human-like it has its cognitive skills, with means of text or speech. It can maintain a conversation with different forms of dialogues and figures of speech. The chatbot tries to simulate human behavior to make the conversation more grasping and realistic. It increases the chances of understanding the deeper roots of the problems. It is an evolving wonder of Artificial Intelligence and Machine Learning. This study discusses about chatbots and their ability to provide many benefits other than simple conversations, namely: Customer Grievance handling, Site Instructions, Mindfulness instructions, Marketing, Sales, etc. They are also used in some parts of the world to study psychology and various other social- related subjects. This study discusses about the different implementation methods, advantages, disadvantages, domains, comparative study, implementation methods etc.*

Key Words: **Chatbots, Artificial Intelligence, Machine Learning, Artificial Intelligence Mark-up Language, Natural language processing, NLP**

1.INTRODUCTION

It is a known fact that chatbots are programmed machines that operate on command unlike people who operate on will. Although you can attempt to give them a natural tone, they will never actually sound human. AI chatbots are very useful in many aspects of today's worlds. They solve a number of problems that may be very crucial and increase human efficiency significantly.

2. LITERATURE REVIEW/COMPARATIVE STUDY

Previous studies and surveys done about AI chatbots and their uses and behavior yielded the following results:

- The Generative models generate a response word by word based on the query. This results in very grammatically inaccurate responses. They learn sentence structures themselves.
- At one large online retailer, a "decision engine" system was responsible for resolving customers' queries, over 95% of the queries returned a response of "transfer to an agent."

- 47% of healthcare insiders have responded that their organization offers an AI training course to their employees. Only 67% said that they support AI adoption in their organization.
- AI algorithms can't be fully trusted unless they're developed and trained. Acquiring high-quality datasets is important.
- AI-based applications are very helpful for youngsters. With growing chaos, anyone can carry out their tasks on the go requiring minimal interaction, using devices like tablets and smartphones.
- AI is used very efficiently in education and is proving to be very useful and cheap. Examples like Third Space Learning, Little Dragon, CTI, Brainly, Carnegie Learning, etc. prove this.
- A significant general issue in AI applications is biased. Since the AI systems generally rely on the volumes of data inputted into them to generate their predictive outputs, it is also important to make sure that the data fed to them is up to the mark and is relevant enough to make the AI system efficient and accurate.

3. PROBLEM FORMULATION

These are examples of problems they can solve:

A. Customer Service: Chatbots have been in use by customer service departments since a long time. Human employees are well adept to pick up the customer request and perform relevant actions. Most support teams are not sure what kind of problem is the user experiencing and it leads to delay and poor customer experience.

B. Sales Assistant: Predictive analysis and statistics suggest that a huge number of big brands will be redesigning their website which allows voice search. This will bring predicted 30% increase in their digital commerce. AI chatbots also collect statistics about customer choices while they interact with a number of customers. They can maintain a dataset and then analyse to make their service better. Whereas, humans can only maintain a little amount of information and it is later difficult to analyse. For an enterprise, the benefits of the detailed data about their customer are huge. It can be used to improve

their business tactics, gain greater business insights and analyse the reasons of customer fall outs.

C. Conversational User Interface: Human therapists help many people battle mental disorders. Whereas AI chatbots have also proved their place in health sector. With their User Interface (UI), they have been helpful for patients with depression, anxiety, aloofness etc. It helps them realise they are not alone and maintains a conversation that ultimately is very similar to a human speech. To AI chatbots, there are endless possibilities because they can be customised and coded in different ways to yield different results.

4. FEASIBILITY ANALYSIS

Chatbots were made to be the alternate for support centre or inquiries specific jobs.

In the hope to utilize the logical and thinking prowess of humans in more regions where necessary. But in reality, it turned out even after 70 years of development an AI chatbot feels rather robotic. The feasibility of a chatbot is not as per expected. Chatbot fails at creating an emotional connection with the user which completely destroys the conversation. The conversations don't last as long as fifteen minutes

Most of the chatbots still do this day are using poor old rule-based techniques. The complexity increases at an exponential level in regards to creating it more humanly.

Artificial intelligence is increasing at the highest rate in the chatbot sector when compared to any other.
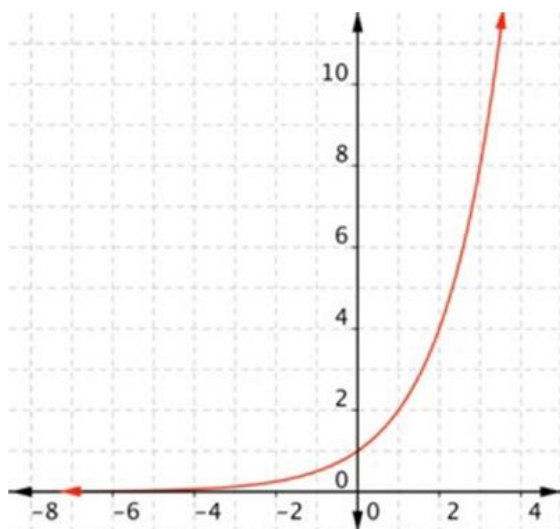

Fig – 1: Complexity of neural networks vs technological improvement curve

The Vertical line here represents the complexity of the Neural Network as in comparison to the improvement as a more human-understandable chatbot.

4.1 Merits of proposed system

A. For Businesses:

- Improved End-User Experience: Chatbots are more efficient as a single chatbot has multiple instances they work in real time with no need for the customers to wait. For the popular and frequently asked questions these bots are trained very well to provide the best suited service quickly. Chatbot also attach documentations, links to the specific forums and etcetera precisely making them much more convenient at times than a human employee.

- Increased Face-time with Customers: Chatbots are a great way to overcome the limitation of workload. There can be multiple instances of a single chatbot inquiring different people at the same time. This ensures faster, easier and more efficient connection. Chatbots can also be integrated into our social media applications increasing the reliability to approach.

- Analytics and Insights: Chatbots works on the data stored about the user. With the Artificial Intelligence it acknowledges the needs and situation of the user well and performs accordingly. In business they take feedback from the customers and then utilise that data and considers it to connect well with the user. This helps both the companies and users.

- Cost Savings and Scalability: It is cheaper to develop a chatbot and integrate it with the backend storage than it is to hire employees. This is very crucial in both small-scale companies and ginormous multinational corporation. This saves money of infrastructure, training, payroll, etc.

B. Cyber Security:

Artificial Intelligence is the new electricity of the upcoming era. It would be integrated everywhere just like electricity nowadays. Artificial Intelligence is a big boon in the region of cyber security.

Some of the known problems resolved by Artificial Intelligence in the realm of cyber security are -

- Increasing the number of cyber threats: Updating the amount of runs of checks by filtering possible places and present new and obscure dangers. The best way to defend against an attack is to know when and where it would take place. Updating the public beforehand to be cautious helps majorly.

- Unsupervised Artificial intelligence can easily point out some defect or abnormality in the network and warn before any potential damage is done. The chatbots collet data and analyse it in lookup for some suspicious patterns or irregularities in the web.

4.2 General Questions:

A. How to bring an AI application that does malware analysis to use?

Any software that's running or is trying to interfere with our code is possible to detect with artificial intelligence. In order to develop an artificially intelligent application that will detect malware we should have a tendency to initially learn the options that may be classified as suspected activity. Some options that may be used:

- Accessed APIs fields on the disk

- Accessing hardware (camera, keyboard etc.) this can be considered under privacy breach.

- Consuming excessive processing power

- Overusing bandwidth over the allocated limit

- Unusual amount of data processed over the internet

B. What is the success rate of using AI to detect cyber-attacks?

This comes out to be pronounced as a multipurpose usability much like the personal assistants developed by the tech giants like Apple, Amazon, Google and many more. Artificial Intelligence integrated in them has shown promising results by detecting threats and other possible cyber-attacks with 80% - 99% accuracy. Many other products started implementing artificial intelligence to provide another layer of smart security against cyber-attacks. One of the examples is Dark Trace. It has negligible results of false positives and extremely high success rate of 99%.

Using chatbots in business usages, they can still be integrated, with the use of Artificial Intelligence, with multiple things and other technologies to provide better customer experience and company security as well.

5. IMPLEMENTATION MODULES

- Bot Chat GUI: User can chat with the bot with the help of a easily made and interactable Graphical User Interface. The GUI can be made using a number of tools. (*for reference see Fig 2*)

- Text to Speech: The bot uses Natural Language Tool Kit (NLTK), a Deep Learning Python Library devised for the use in programs using language-based output and input. The Model is trained using Keras and TensorFlow python packages.

- Rule based models are very easy to use. But for a beginner or a new person, it is very difficult to train them to answer the complex requests accurately.

- Generative Models: Based on the question or query given to them, they generate a response that is indicative of how intelligent they can be. But often their responses are grammatically incorrect. To make them accurate, is a very difficult task.

5.1 THE ENCODER-DECODER MODEL

Rule based chatbots and neural network based chatbot differs as the latter have a learning algorithm. The process of a rule-based network is as an "encoder" that reads the input and transforms it into a rich fixed length vector. It is then used to create a target sentence after passing through the "decoder". Whereas in the RNN a complex neural network is established instead of a simple encoder. A recurrent neural network (RNN) is a neural network that can take as input a variable length sequence

$$x = (x1,...,xn)$$

and produce a sequence of hidden states

$$h = (h1,...,hn)$$

by using recurrence. With the increase in the number of steps it's harder for a simple RNN to remember all this information.

6. IMPLEMENTATION METHOD

A. Libraries and Data

The libraries are imported using the following code:

```
import nltk
nltk.download('punkt')
nltk.download('wordnet')
from nltk.stem import WordNetLemmatizer
lemmatizer = WordNetLemmatizer()
import json
import pickle
import numpy as np
from keras.models import Sequential
from keras.layers import Dense,
Activation, Dropout
from keras.optimizers import SGD
import random
```

B. Training the Chatbot

'training.py' file consists of the code. The code is read in natural language and is transformed into a training set. As you can see in the given code snippets, A model is created by importing Keras Sequential Neural Network. The following code initializes the lists where the natural language data is stored.

```
words=[]
classes = []
documents = []
ignore_words = ['?', '!']
data_file = open('intents.json').read()
intents = json.loads(data_file)
```

The Deep Learning Model used from Keras is Sequential. The model will be trained with stochastic gradient descent, Stochastic gradient descent is more efficient than normal gradient descent. After the model is

trained by executing the file training.py, a new file named "chatbot_model" will be created by the algorithm.

'classes.pkl' — file with a list of different types of responses divided into classes.

'words.pkl' — file with a list of different words that could be used for pattern recognition

'intents.json' — file that consists of JavaScript objects that list different tags that point to different types of word patterns in form of json. It is used by the program to identify what to reply according to the stated invoking statements.

C. Graphical User Interface

'chatgui.py' file consists of the code for picking up the responses according to the model's predictions and creating a graphical interface for the chatbot using a python library for GUI called 'tkinter'. There are many other opensource libraries available that are still in development.

```
import tkinter
from tkinter import *
#Create Chat window
ChatLog = Text(base, bd=0, bg="white",
height="8", width="50", font="Arial",)
ChatLog.config(state=DISABLED)
#Bind scrollbar to Chat window
scrollbar = Scrollbar(base,
command=ChatLog.yview, cursor="heart")
ChatLog['yscrollcommand'] = scrollbar.set
#Create Button to send message
SendButton = Button(base,
font=("Verdana",12,'bold'), text="Send",
width="12", height=5,
                    bd=0, bg="#32de97",
activebackground="#3c9d9b",fg='#ffffff',
                    command= send
#Create the box to enter message
EntryBox = Text(base, bd=0,
bg="white",width="29", height="5",
font="Arial")
#EntryBox.bind("<Return>", send)
#Place all components on the screen
scrollbar.place(x=376,y=6, height=386)
ChatLog.place(x=6,y=6, height=386,
width=370)
EntryBox.place(x=128, y=401, height=90,
width=265)
SendButton.place(x=6, y=401, height=90)

base.mainloop()
```

This implementation is with respect to a chatbot integrated with the website of some medical institution/organisation. To run this Chatbot, python programming language along with its Deep Learning library Keras and TensorFlow is required.

7. AREAS OF IMPROVEMENT

A. Using different Neural Network: The Keras neural network used here is one of the simplest ones. For more complex uses, there are many other and hence a lot of upgrades could be done. Others such as convolutional networks or recurrent networks could also be used for the same.

B. Data Volume: The (.json) file used was extremely tiny and there wasn't any variety in the types of responses available for the system to respond with. Human language is very complex for the computer to understand, Creating a program with a vast measure of words from each human language is a great task only a large workforce can tackle for professional use.

C. Using different frameworks: There are many more Deep Learning frameworks such as TensorFlow, Apache Spark, PyTorch, Sonnet, etc.

The following image shows the demo GUI and output of how the Chatbot will respond:
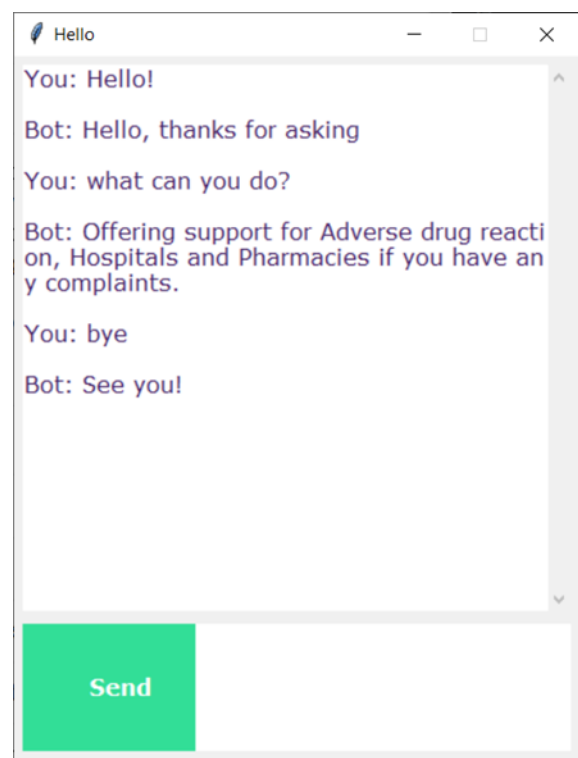

Fig – 2: Output screen for the sample chatbot implementation

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